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(54) ICE HOCKEY STICK WITH FIBRE REINFORCED HANDLE

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ABSTRACT OF THE DISCLOSURE

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This specification discloses an improved ice hockey

stick in which strips of reinforcing plastic material are embedded into the wide side surfaces of the handle portion of an ice hockey stick which otherwise is made of suitable hardwood.

The construction is such that the completed hockey stick handle will be perceived by the hockey player as a conventional wooden hockey stick and not as a hockey stick whose handle is made of plastic or is covered with plastic material.

An improved method for making handles for hockey sticks is disclosed wherein the reinforcing strips are applied to a large number of handles which are pressed together in a suitable apparatus before installation of the blades to the lower extremity of the handle component.

and in the case of the stronger hockey players it is becoming increasingly difficult to supply a hockey stick which will last even only one complete hockey game.

The difficulty is compounded by the fact that the amount of high quality hardwood suitable for producing hockey sticks becomes more and more limited and this increases the costs of the raw material which is very substantial in relation to the overall costs of production.

Hockey stick handles made of laminated hardwood have
10 therefore been developed but the higher quality laminated hockey stick handles must be made of very thin laminations and are accordingly very costly.

In the recent years a composite hockey stick construction was developed wherein an ordinary hardwood hockey stick is produced after which thin layers of reinforcing material such as fiberglass are glued over each side of the hockey handle and shank portion and in some cases the sheets of fiberglass extend partly or completely over the length of the blade. Such plastic covered hockey sticks however are relatively expensive in that
20 the plastic coverings must be applied on each hockey stick individually, the shank portion of the hockey handle tends to be overly rigid with the result that the shocks tend to be transmitted to the arms of the hockey player, and the handle portion of the hockey stick is no longer perceived by the hockey player as a wooden handle. Consequently the above described plastic covered hockey sticks are not always considered as an improved substitute for good hardwood hockey sticks.

We have found that a vastly improved hockey stick can be produced by using a hockey stick handle component wherein
30 lateral strips of reinforcing inextensible material are imbedded into the wide side surfaces of the handle component and extending from the free extremity of the handle component throughout

the length of the handle but terminating short of the heel portion of the hockey stick.

We have also discovered that this method of production permits the use of hardwood being solid or laminated of less than top grade to produce very high quality hockey sticks at reduced costs.

It is therefore an object of the invention to produce a wooden type ice hockey stick which will meet the most demanding requirements, and which can be mass produced at a reasonable
10 cost.

Another object is to provide a reinforced hockey stick handle which will be perceived by the hockey player as an essentially wooden hockey stick handle.

A further object of the invention is to provide a method for manufacturing hockey stick handles on a mass production basis.

In accordance with this invention we provide a ice hockey stick which consists of a handle, a blade and a shank extending from the handle for connecting the blade to the handle, the handle and the shank being integrally formed of a wooden component whereas the blade, being made of solid hardwood, is connected to the lower end portion of the shank by gluing. The wooden component is elongated and straight and its cross-section is essentially rectangular and uniform throughout the handle and then gradually reduces in cross-section along the length of the shank from the lower end of the handle to the region of connection with the blade. The wooden component has throughout the length of the handle two opposite wide side surfaces, a top narrow surface and a bottom narrow surface. The wooden component comprises at each wide side surface an inextensible reinforcing rigid strip of constant cross-section made of longitudinally aligned fibers bonded together. Each strip is embedded into a correspondingly shaped groove into the wooden component extending throughout the length of the handle. Each reinforcing strip is flush with the associated side
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surface, is permanently secured to the wooden component by suitable adhesive, is located centrally of the associated wide side surface, and is at least slightly narrower than the associated side surface. The bottom of each groove is at a constant distance from the bottom of the opposite groove which constant distance corresponds essentially to the distance between the wide side surfaces of the wooden component in the upper region of the shank.

A ice hockey stick is also produced wherein each strip
10 is relatively wide and thin being of constant rectangular cross-section. Alternatively each strip consists of two spaced apart narrow strip members disposed in respective parallel grooves located inwardly of the corner surfaces.

In a different embodiment each strip is of rectangular cross-section and is disposed in a relatively narrow groove located in the middle of the associated wide surface throughout the length of the handle and partly into the shank.

In a still different embodiment of the invention, the groove for each strip of reinforcing material is deeper than the thickness of the associated strip which is ultimately covered with a thin layer of wooden material and consequently the reinforcing material is completely hidden in the handle portion of the hockey stick handle component.

In still another different embodiment, the hockey stick handle component is made of a relatively thin wooden component whose opposite wide surfaces are covered with a layer of reinforcing material which in turn are covered with a further thin layer of wood, the assembly being held together by suitable adhesive.

30 The invention also provides a method of making a wooden component to be used in the manufacture of hockey sticks which comprises the steps of making at least one shallow groove of

constant cross-section in each wide side surface of an elongated piece of hardwood of constant rectangular cross-section and whose four corners are defined by narrow surfaces cut at 45 degrees inserting into each groove a conforming strip of glass-fiber material whose mating surfaces are coated with a suitable adhesive, and pressing the strips into their respective grooves until substantial curing of the adhesive.

Exemplary embodiments of this invention will now be described in details with reference to the accompanying drawings
10 in which:

Figure 1 is an oblique view of the upper end portion of a hockey stick handle,

Figure 2 is a perspective view in reduced scale of a ice hockey stick,

Figures 3, 4 and 5 are cross-sectional views respectively taken along lines 3-3, 4-4, and 5-5 in Figure 2,

Figures 6, 7, 8, 9 and 10 are cross-sectional views corresponding to the cross-section at line 5-5 in Figure 2 but relating to different embodiments,

20 Figures 11, 12, 13 and 14 are cross-sectional views of different constructions of laminated hockey stick handles,

Figure 15 is an oblique view showing a free end of a grooved handle component, and

Figure 16 is a front elevated view of a plurality of handle components into a press.

In Figures 1 and 2 a ice hockey stick is illustrated, particularly in Figure 2 at reference numeral 10 as consisting of a handle component 12 made essentially of hardwood and terminating into an enlarged heel portion 14 to which a blade 16
30 is secured. Blade 16 is normally made of solid hardwood as a one piece component although in certain cases it may be made of two or more pieces glued together. The inner end of blade 16

is of reduced cross-section and fits into a slot in the heel portion 14 and a high quality wood glue is used for retaining the blade 16 to the handle component 12. In the illustration of Figure 2 the details of the connection of the blade to the handle component 12 have been omitted because this is conventional in the art of hockey stick construction and is not part of the present invention.

The handle component 12 defines a handle 18 which extends from the upper free end of handle component 12 as shown at reference numeral 20 down to the region identified by reference numeral 22 which shows the beginning of shank portion 24 which terminates into heel portion 14.

Handle component 12 is a straight elongated piece of hardwood of rectangular cross-section and the exact cross-sections are shown in greater detail in Figures 3, 4 and 5 which are respectively taken along lines 3-3, 4-4, and 5-5 shown in Figure 2. The cross-section of handle component 12 is constant throughout the handle and gradually reduces throughout the shank region 24. Good quality hardwood is used for constructing ice 20 hockey sticks and the preferred solid hardwood materials are white ash, hickory and rock elm. Handle components can also be made of various types of laminates and Figures 11, 12, 13 and 14 illustrate in cross-sectional views corresponding to that of Figure 5 four different lamination constructions which are currently available for making handles for hockey sticks. In Figure 11 the laminations 30 are relatively thick and made of hardwood and disposed in the vertical plane. The laminations 31 in Figure 12 are disposed in the horizontal plane and are also made of relatively thick hardwood laminates. Figure 13 shows a hollow 30 core box lamination consisting of two groups of softwood thick laminations 33 and 34 stacked horizontally into two spaced apart groups leaving a hollow space 36 of rectangular cross-section,

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and two series of very thin high quality hardwood laminates 38 disposed vertically and defining the two wide side surfaces of the handle component. The laminated construction of Figure 13 tends to be very strong and light-weight but is also extremely expensive to produce. The Figure 13 shows a different box lamination comprising an arrangement of thick horizontal laminates 40 and side vertical laminates 42 defining the wide side surfaces of the handle component 12.

Thus the material used in making hockey stick handle components 12 are elongated pieces of hardwood of rectangular cross-section having two wide side surfaces and two narrow top and bottom surfaces and normally the four corners have been cut at 45° thus defining very narrow corner flat surfaces between the adjacent main surfaces, and the cross-section of the starting material is constant throughout the length of the piece of hardwood which normally measures about 58 inches. Using a basic handle piece, the successive steps in the making of a hockey stick comprise adding a short block 44 to one narrow surface at one end of the handle component, and once block 44 has been glued in place, the bottom part of the assembly is provided with a longitudinal slot for receiving the inner end of blade 16 and the assembly is secured together by proper gluing under pressure. The arrangement is then cut to the proper profile by means of a blade saw or the like followed with a coarse sanding operation designed to taper the shank portion of the handle component and to also reduce the thickness of blade 16 to about $\frac{1}{4}$ inch. The entire hockey stick is then submitted to fine sanding especially the lower portion thereof and it is common to reinforce the heel portion of the hockey stick and sometimes also the entire shank portion and the inner region of blade 16 by winding a thin flexible strip of glass fiber secured in place against the wooden surface of the hockey stick by means

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of a proper adhesive such as an epoxy glue.

In accordance with this invention, however, the basic piece of hardwood for preparing the handle component 12 comprises at least one shallow groove along each wide side surface of the piece of wood as best seen in Figure 15. Grooves 50 and 51 which are equally spaced from the opposite top and bottom surfaces 54 and 56 receive an inextensible reinforcement in strip form which are best shown in Figure 1 at 60 and 62. The reinforcements 60 and 62 closely conform to the shape of their respective grooves 50 and 52 and are glued to the surrounding wood of the handle component 12.

The reinforcing strips 60 and 62 are mounted to the handle component 12 before the construction of the hockey stick structure, namely before installation of block 44 and blade 16. As shown in Figure 16, a plurality of hockey stick handles 70 are disposed parallel to one another over table 72 on one of their respective narrow sides and are pressed together by means of inwardly urging side members 75 and 76 which maintain an inwardly directed force until substantial curing of the reinforcing strips 78 to the associated piece of hardwood 80. The assembly can be maintained in straight line by means of an upper bar 82 which may be locked in the lower position illustrated in Figure 16 by rods 84. In practice, each table 72 can receive over twenty hockey stick handles during each curing cycle, and the curing can take place at room temperature when using a suitable epoxy glue.

The basic piece of hardwood used for constructing hockey stick handle components in accordance with this invention can be solid hardwood as shown in Figure 1 but could also be made of laminated hardwood using for example any of the four designs illustrated in Figures 11, 12, 13, and 14. In practice the laminate construction shown in Figure 11 being a thick vertical hardwood lamination is preferred on account of its low cost and wide

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availability.

When producing an ice hockey stick in accordance with the present invention, the basic piece of hardwood for making the handle component 12 is first provided with side grooves 50 and 52; the side reinforcing strips 60 and 62 are then glued in place, each strip extending from the upper free end 20 of the handle component 12 and terminating at least a short distance beyond the lower region of handle 18 which is illustrated at 22 in Figure 2, after which the rest of the operations are conventional, namely the addition of a small block 44, the provision of a slot in the heel portion of the assembly, followed with gluing of the blade component 16 into the heel portion 14, shaping of the lower portion of the hockey stick, followed by coarse sanding of the entire lower portion of the hockey stick. The coarse sanding operation which is designed to make the heel and blade portion thinner will also provide a gradual transverse tapering throughout the shank portion 24. Consequently, the lower portions of reinforcing strips 60 and 62 will also gradually taper from the lower region of handle 18 and will completely disappear at some point along shank 24, leaving the lower region of shank 24 without any reinforcement. The absence of reinforcement in the middle and lower region of shank 24 is a very desirable feature in that this lower portion of the hockey stick should be slightly more flexible than the handle 18 in order to absorb some of the shocks which otherwise would be directly transmitted to the arms of the hockey player and also to permit springing back of the blade portion 16 resulting in faster shooting. The position of the lowest extremity of reinforcing strips 60 and 62 as at 90 in Figure 2 will be determined by the depth of grooves 50 and 52 in the basic piece of wood used for making the handle, which depth should be constant, and by accurately controlling the coarse sanding operation of the lower region of the hockey

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stick.

The construction of the hockey stick will be completed by a fine sanding operation followed, if necessary, with wrapping of the lower region of the hockey stick, particularly the heel portion 14 thereof, with a thin and very flexible piece of glass fibre material normally in loosely woven form, and retained in place by a suitable binding, such as an epoxy glue.

Referring now to Figure 5, which is a cross-section taken along line 5-5 in Figure 2, we can see that each reinforcing strip 60 or 62 has three of its surfaces in mating engagement with the surrounding wood of the hardwood core 100 and these mating surfaces are glued to the surrounding wood. The fourth surface of each strip, identified by reference numerals 102, 104 are flush with the adjacent margins 104 of the respective side surfaces 106. Consequently, the top and bottom narrow surfaces 108 and 110 and all four corners 112 plus margins 104 on each side surface 106 are wood surfaces and will be felt as such by the hands or gloves of the hockey player giving the impression of an entirely wooden hockey stick handle.

The reinforcing strips 60 and 62 are made of longitudinally extending glass fibre material consisting of continuous strands of textile yarns where glass fibres and graphite fibres are combined and held together as a rigid structure by a suitable binder. Preferably, the glass fibre material will contain between 60% and 70% by weight of glass and graphite fibres, and the preferred binder is epoxy resin. In a preferred embodiment, the graphite fibres are high tensile fibres made from polyacrylonitrile, for example, the graphite yarn sold under the trade mark THORNEL developed by the Union Carbide Corporation in the United States. The reinforcing material should have a tensile strength which is considerably higher than that of the hardwood used as the handle's core 100, and the purpose of the reinforcing strips 60 and 62 is to greatly

strengthen the handle portion 18 of a hockey stick without increasing its weight. However, in practice it has been found that the use of embedded reinforcing strips in accordance with this invention will also permit the use of cores made of less than top grade hardwood or hardwood laminates resulting in a very high quality hockey stick produced at comparatively low costs. In effect, the provision of two spaced-apart inextensible strips held together by a core such as at 100 acts in the manner of an I-beam or H-beam when subjected to shooting efforts
10 by the hands of the hockey player.

In Figure 6 a different embodiment is illustrated by means of a cross-sectional view corresponding to that of Figure 5. Each reinforcing strip is made of two spaced-apart inextensible components 120 and 122 disposed in respective parallel slightly spaced-apart grooves on each wide surface 130 of core 132.

In Figures 7 and 8 the reinforcing strips 140 and 150 are of more compact design and of greater thickness than the strips shown in Figures 5 and 6. The reason for using strips of greater depth is, of course, to extend the length of their tapering ends into the middle region of shank portion 24.
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In Figure 9 the reinforcing strips 162 and 164 are disposed into grooves which are deeper than the thickness of strips 162 and 164 and each strip is covered with a very thin layer 166 of wood resulting in a hockey stick handle 12 whose exterior surface is completely free of plastic areas.

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In Figure 12 a different construction is used wherein the central core 170 is thinner than those used in the embodiments illustrated in Figures 5 to 9; full width strips of reinforcing material 172 and 174 are glued on each wide side surface of core 170 and the outside surface of each reinforcing strip 172 or 174 is covered with a thin layer of wood 176 with
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the result that the outside surface of the handle component 12 will be completely wood with the exception of narrow strips 178 at each corner.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1- An ice hockey stick comprising a handle component made of hardwood and defining a handle of rectangular, constant cross-section having four flat surfaces and an integrally formed shank extending from the lower end region of said handle, a blade secured to the lower end portion of said handle component, and an inextensible rigid reinforcement in strip form comprising continuous longitudinally aligned fibres, embedded centrally in each wide side surface of said handle component extending throughout said handle and terminating in the upper region of said shank, said reinforcement being glued to the surrounding wood of said handle component, each reinforcement being of constant cross-section throughout the length of said handle, said reinforcements extending strictly parallel to each other throughout their extent, each reinforcement being a relatively wide, thin strip of glass-fiber material of rectangular cross-section having three surfaces in contact with and glued to the surrounding wood of a closely conforming groove in the middle of a wide side surface of said handle component, the distance between the bottom surfaces of said grooves being constant throughout their extent, the fourth surface of each said strip being essentially flush with the wooden marginal edges of the associated side surface and wherein said glass-fiber material is made of continuous strands of textile yarns containing between 60 to 70% by weight of glass fibers and graphite fibers in an epoxy resin binder.

2- An ice hockey stick as defined in claim 1 wherein said graphite fibers are high-tensile fibers made from polyacrylonitrile.

3- An ice hockey stick consisting of a handle, a blade, and a shank extending from said handle for connecting said blade to said handle, said handle and said shank being integrally formed of a wooden component and said blade being made of solid hardwood, the inner end of said blade being glued on the lower end portion of said shank, said wooden component being elongated and straight, and its cross-

section being essentially rectangular and uniform throughout the said handle and then gradually reducing along the length of said shank from the lower end portion of said handle to the region of connection with said blade, said wooden component having throughout the length of said handle two opposite wide side surfaces, a top narrow surface, a bottom narrow surface, and four essentially flat corner surfaces being considerably narrower than said top and bottom narrow surfaces, said wooden component comprising at each wide side surface an inextensible rigid reinforcing strip of constant cross-section embedded into a correspondingly shaped groove into said wooden component extending throughout the length of said handle, each reinforcing strip comprising longitudinally aligned high tensile strength fibres, being permanently secured to said wooden component by a suitable adhesive, terminating essentially flush with the associated wide side surface, being located centrally of said associated wide surface, and terminating short of the nearest corner surfaces, the bottom of each groove being at a constant distance from the bottom of the opposite groove which constant distance corresponds essentially to the distance between the wide side surfaces of the said wooden component in the upper region of said shank.

4- An ice hockey stick as defined in claim 3 wherein each strip is relatively wide and thin being of constant rectangular cross-section and extending practically the full width of each wide side surface.

5- An ice hockey stick as defined in claim 3 wherein each strip consists of two spaced apart narrow strip members disposed in respective parallel grooves disposed inwardly of said corner surfaces.

6- An ice hockey stick as defined in claim 3 wherein each strip is of rectangular cross-section being wider than its thickness and disposed in a relatively narrow groove extending in the middle of the associated wide surface throughout the length of said handle and partly into said shank.

7- An ice hockey stick comprising a handle component made of hardwood and defining a handle of rectangular, constant cross-section having four flat surfaces and an integrally formed shank extending from the lower end region of said handle, a blade secured to the lower end portion of said handle component, and an inextensible rigid reinforcement in strip form comprising continuous longitudinally aligned fibres, embedded centrally in each wide side surface of said handle component extending throughout said handle and terminating in the upper region of said shank, said reinforcements being glued to the surrounding wood of said handle component, each reinforcement being of constant cross-section throughout the length of said handle, said reinforcements extending strictly parallel to each other throughout their extent, each reinforcement being of rectangular cross-section and disposed in a correspondingly shaped but deeper groove in the corresponding side surface of said handle component, and wherein each reinforcement is covered with a thin strip of wood flush with the wooden marginal edges of the associated side surface.

8- An ice hockey stick comprising a handle component made of hardwood and defining a handle of rectangular, constant cross-section having four flat surfaces and an integrally formed shank extending from the lower end region of said handle, a blade secured to the lower end portion of said handle component, and an inextensible rigid reinforcement in strip form comprising continuous longitudinally aligned fibres, embedded centrally in each wide side surface of said handle component extending throughout said handle and terminating in the upper region of said shank, said reinforcements being glued to the surrounding wood of said handle component, each reinforcement being of constant cross-section throughout the length of said handle, said reinforcements extending strictly parallel to each other throughout their extent, each reinforcement being in the form of a strip of rectangular cross-section whose width is equal to the longest transverse dimension of said handle, and wherein each strip is covered with a strip of wood

defining the side surfaces of said handle, the assembly being held together by glueing.

9- A method of making a handle component for the construction of ice hockey sticks, comprising the steps of making at least one shallow groove of constant depth in each wide side surface of an elongated piece of hardwood of predetermined constant rectangular cross-section whose four corners are defined by narrow flat surfaces at 45 degrees with the adjacent surfaces, the arrangement of at least one groove in each wide side surface being located centrally of the associated wide side surface and each groove extending throughout the length of said piece of hardwood, inserting into each of said grooves a rigid strip of longitudinally aligned glass-fiber material whose dimensions closely conform to those of said grooves, the bottom surface and the two edges of each strip having a coating of suitable adhesive, inwardly pressing said strips into their respective grooves and maintaining the pressure until substantial curing of said adhesive.

10- A method as defined in claim 9 wherein during the curing step a plurality of stick handles are disposed parallel to one another over a table on one of their narrow sides and pressed together between two inwardly urging side members.

11- A method of making a composite hockey stick having a handle, a blade and a shank extending from said handle for connecting said blade to said handle, said handle and said shank being integrally formed and defining a handle component, and the lower region of said shank defining the heel portion of said hockey stick, said method comprising:

- as a first step preparing a constant cross-section reinforced handle component according to the method of claim 10, and glueing a short block of wood to a narrow surface of said handle component at the lower end thereof

- as a second step cutting a longitudinal slot at an angle through said block and handle component for the blade component

- as a third step permanently securing the inner end of said blade component into said slot with said block positioned between said blade and said handle component

- as a fourth step cutting the assembly comprising said handle component, said block and said blade component to the approximate profile desired

- as a fifth step coarse sanding the lower portion of said assembly for reducing the thickness of said blade component to about 1/4 of an inch and for tapering the lower portion of said handle component and block thereby to define said shank which is gradually tapering from said handle to said heel portion, said coarse sanding step being accurately controlled for removing the lower end of said rigid strips to a predetermined region in the upper part of said shank

- as a sixth step fine sanding said lower portion of said assembly for obtaining the final desired shape of said shank of said blade and of said heel portion.

12- A method of making a composite hockey stick as defined in claim 11 comprising as a final step winding a thin flexible strip of glass fiber around said heel portion and securing said flexible strip in place by means of a suitable adhesive.

13- A method of making a composite hockey stick as defined in claim 11 comprising as a seventh step winding a thin flexible strip of glass fiber around at least the inner region of said blade, around said heel portion and around said shank and securing said flexible strip in place by means of a suitable adhesive.

14- An ice hockey stick comprising a handle component made of hardwood and defining a handle of rectangular, constant cross-section having four flat surfaces and an integrally formed shank extending from the lower end region of said handle a blade secured to the lower end portion of said handle component, and an inextensible rigid reinforcement in strip form comprising longitudinally aligned fibres embedded centrally in each wide side surface of said handle component, extending from the free end of said handle component to the shank thereof, and being glued to the surrounding wood of said handle component and said reinforcements being parallel to each other and being of constant cross-section throughout the length of said handle.

15- An ice hockey stick comprising a handle component made of hardwood and defining a handle of rectangular, constant cross-section having four flat surfaces and an integrally formed shank extending from the lower end region of said handle, a blade secured to the lower end portion of said handle component, and an inextensible rigid reinforcement in strip form comprising longitudinally aligned fibres embedded centrally in each wide side surface of said handle component extending throughout said handle and terminating in the upper region of said shank, said reinforcements being glued to the surrounding wood of said handle component, each reinforcement being of constant cross-section throughout the length of said handle and said reinforcements extending strictly parallel to each other throughout their extent, said blade being considerably thinner than said handle and said shank tapering gradually from said handle to the heel portion of said hockey stick, the lower end portion of said reinforcements being tapered, and the entire outer surface of each reinforcement being flush with the surrounding wood of said handle component.

16- A method of making a handle component for the construction of ice hockey sticks, comprising the steps of making at least one shallow groove of constant depth in each wide side surface of an elongated piece of hardwood of predetermined constant rectangular cross-section whose four corners are defined by narrow flat surfaces at 45 degrees with the adjacent surfaces, the arrangement of at least one groove in each wide side surface being located centrally of the associated wide side surface and each groove extending throughout the length of said piece of hardwood, inserting into each of said grooves a pre-formed reinforcing strip offering great resistance to elongation when compared to hardwood, which strip is of the same width as its receiving groove while the thickness of said strip is at least equal to the depth of said receiving groove, the bottom surface and the two edges of each strip having a coating of suitable adhesive inwardly pressing said strips into their respective grooves and maintaining the pressure until substantial curing of said adhesive.

17- A method of making a composite hockey stick having a handle, a blade and a shank extending from said handle for connecting said blade to said handle, said handle and said shank being integrally formed and defining a handle component, and the lower region of said shank defining the heel portion of said hockey stick, said method comprising:

- as a first step preparing a constant cross-section reinforced handle component according to the method of claim 16, and glueing a short block of wood to a narrow surface of said handle component at the lower end thereof

- as a second step cutting a longitudinal slot at an angle through said block and handle component for the blade component

- as a third step permanently securing the inner end of said blade component into said slot with said block positioned between said blade and said handle component

- as a fourth step cutting the assembly comprising said handle component, said block and said blade component to the approximate profile desired

- as a fifth step coarse sanding the lower portion of said assembly for reducing the thickness of said blade component to about 1/4 of an inch and for tapering the lower portion of said handle component and block thereby to define said shank which is gradually tapering from said handle to said heel portion, said coarse sanding step being accurately controlled for removing the lower end of said rigid strips to a predetermined region in the upper part of said shank

- as a sixth step fine sanding said lower portion of said assembly for obtaining the final desired shape of said shank of said blade and of said heel portion

18- An ice hockey stick comprising a handle component made of hardwood and defining a handle of rectangular, constant cross-section having four flat surfaces and an integrally formed shank extending from the lower end region of said handle, a blade secured to the lower end portion of said handle component, and an inextensible rigid reinforcement in strip form comprising longitudinally aligned fibres embedded centrally in each wide side surface of said handle component extending throughout said handle and terminating in the upper region of said shank, said reinforcements

being glued to the surrounding wood of said handle component, each reinforcement being of constant cross-section throughout the length of said handle and said reinforcements extending strictly parallel to each other throughout their extent, said blade being considerably thinner than said handle and said shank tapering gradually from said handle to the heel portion of said hockey stick and with the lower end portion of said reinforcements being tapered.

19- An ice hockey stick comprising a handle component made of hardwood and defining a handle of rectangular, constant cross-section having four flat surfaces and an integrally formed shank extending from the lower end region of said handle, a blade secured to the lower end portion of said handle component, and an inextensible rigid reinforcement in strip form comprising longitudinally aligned fibres embedded centrally in each wide side surface of said handle component extending throughout said handle and terminating in the upper region of said shank, said reinforcements being glued to the surrounding wood of said handle component, each reinforcement being of constant cross-section throughout the length of said handle, said reinforcements extending strictly parallel to each other throughout their extent and wherein each reinforcement strip is tapered in the shank portion of said handle component.

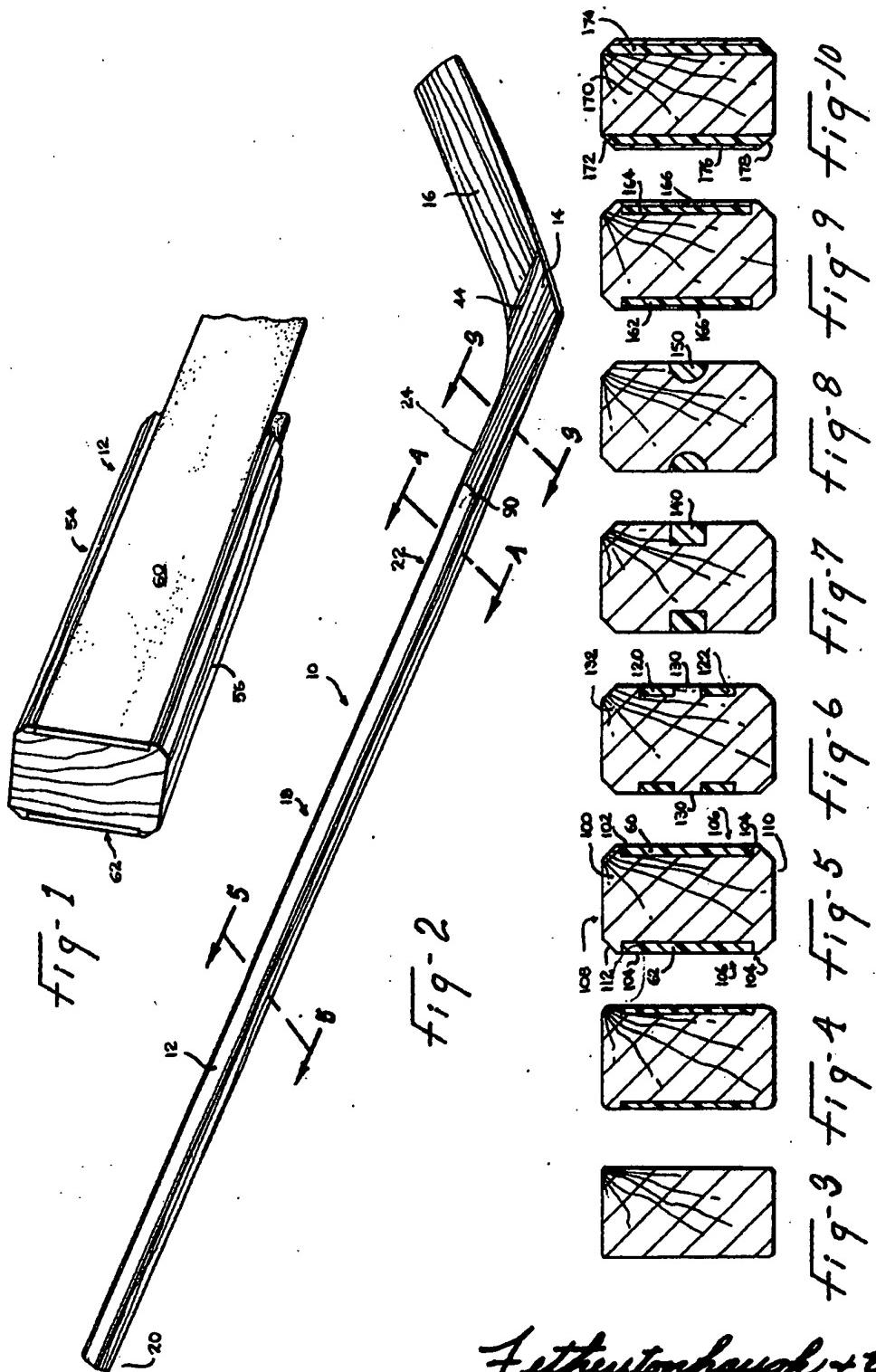
20- An ice hockey stick comprising a handle component made of hardwood and defining a handle of rectangular, constant cross-section having four flat surfaces and an integrally formed shank extending from the lower end region of said handle, a blade secured to the lower end portion of said handle component, and an inextensible rigid reinforcement in strip form comprising continuous longitudinally aligned fibres, embedded centrally in each wide side surface of said handle component extending throughout said handle and terminating in the upper region of said shank, said reinforcement being glued to the surrounding wood of said handle component, each reinforcement being of constant cross-section throughout the length of said handle,

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said reinforcements extending strictly parallel to each other throughout their extent, each reinforcement being a strip of glass-fiber material wherein said glass-fiber material is made of continuous strands of textile yarns containing between 60 to 70% by weight of glass fibers and graphite fibers in an epoxy resin binder.

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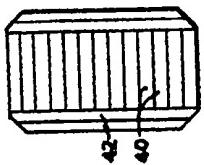


Fig 9-14

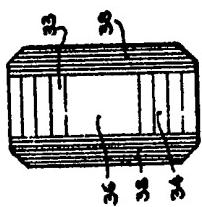


Fig 9-13

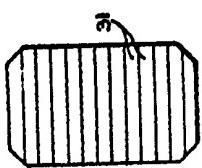


Fig 9-12

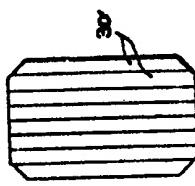


Fig 9-11

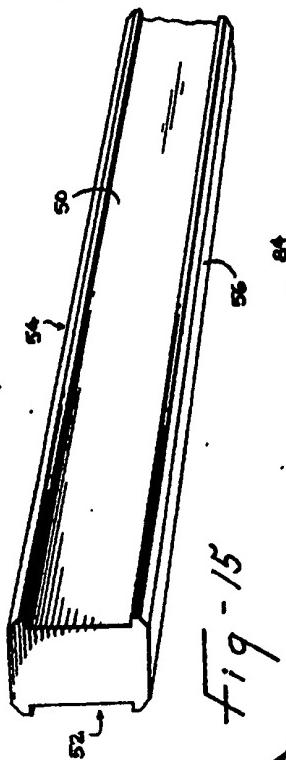


Fig 9-15

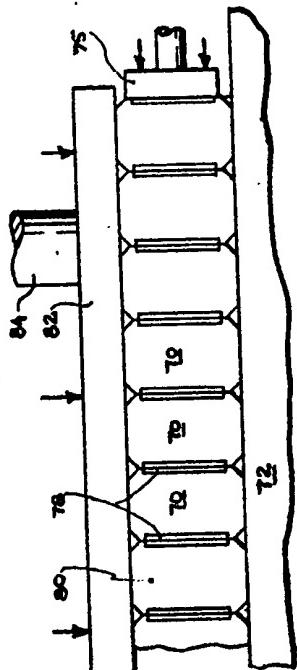


Fig 9-16

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